

What is claimed:

1. A composition comprising a pre-formed, hydrolytically susceptible polyanionic polymer comprising:

5 at least one linking moiety comprising a hydrolytically susceptible bond; and  
linked to the linking moiety at least two polyanionic polymer segments,  
wherein all polyanionic polymer segments in the polymer are linked to the whole by a  
said linking moiety, and 90% or more of the polyanionic polymer segments in the  
composition have molecular weight of 50 kd or less.

10 2. The composition of claim 1, wherein 90% or more of the polyanionic  
polymer segments in the composition have molecular weight of 40 kd or less.

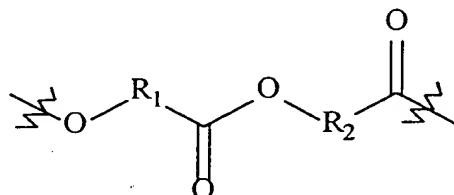
15 3. The composition of claim 1, wherein the average molecular weight of the  
polyanionic acids segments in the composition is from 20 kd to 40 kd.

20 4. A method of making the composition of claim 1, comprising:  
reacting by free radical-mediated polymerization (a) monomers adapted to create  
polyanionic polymer segments in the presence of crosslinking reagent  
adapted to create, following free-radical-mediated incorporation into  
polymer, the linking moieties; and  
contacting the reacting monomers with a chain-elongation terminator in an  
amount adapted to limit the molecular weight of the polyanionic polymer  
segments.

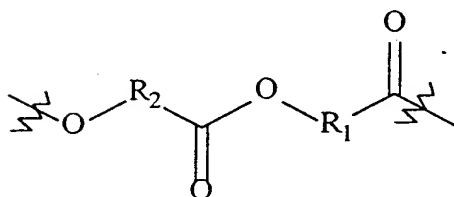
25 5. A composition comprising a pre-formed, hydrolytically susceptible  
polyanionic polymer comprising:  
polyanionic polymer segments, wherein 90% or more of the polyanionic polymer  
segments in the composition have molecular weight of 50 kd or less; and  
linking the polyanionic segments at least one linking moiety comprising

(a) a core which is a C<sub>1</sub> to C<sub>12</sub> alkylene with three or more linking oxy or thio groups or a mono or disaccharide with three or more terminal oxy groups;

(b) linked to each linking oxy or thio, -R<sup>3</sup><sub>n</sub>-, where n is zero or greater with the total sum of the n values being at least three, and the R<sup>3</sup> radicals are independently:



or



wherein the carbonyl radical is linked to the linking oxy or thio, and wherein R<sup>1</sup> and R<sup>2</sup> are independently methylene or ethylene which can be substituted with up to two C<sub>1</sub> to C<sub>4</sub> alkyls; and

(c) the residue after incorporation into the polyanionic polymer segments of unsaturated moieties that are ester or ether linked to by oxy of R<sup>3</sup>.

6. The composition of claim 5, wherein the average molecular weight of the polyanionic acids segments in the composition is from 20 kd to 40 kd.

7. A method of making the composition of claim 5 comprising:

reacting by free radical-mediated polymerization (a) monomers adapted to create polyanionic polymer segments in the presence of crosslinking reagent adapted to create, following free-radical-mediated incorporation into polymer, the linking moieties; and

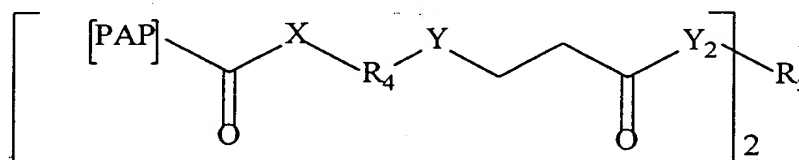
contacting the reacting monomers with a chain-elongation terminator in an amount adapted to limit the molecular weight of the polyanionic polymer segments.

- 5            8.     A polyanionic polymer comprising:  
two or more linearly linked polyanionic polymer segments linked via terminating oxo or thio moieties derived from a hydroxide or thiol moieties; and linker moieties cleavable at internal amide, ester or thioester bonds linking the linkers to form the linear polyanionic polymer segments.

- 10           9.     The polyanionic polymer of claim 8, wherein the polyanionic polymer comprises a monomer moiety which consists of atoms selected from carbon, hydrogen, oxygen and sulfur and comprises carbon and hydrogen.

- 15           10.    The polyanionic polymer of claim 8 wherein the linearly linked polyanionic segments are crosslinked hydrolytically susceptible linking moieties.

- 20           11.    A polyanionic polymer comprising:  
polyanionic polymer segments (PAP) containing carboxylates; and  
linkers crosslinking the polyanionic polymer segments having the structure:



- 25           , wherein the illustrated carbonyls adjacent to PAP are derived from the carboxylates, and wherein X, Y and Y<sup>2</sup> are independently S, O or NH and R<sup>4</sup> is a straight chain C<sub>1</sub>-C<sub>10</sub> alkyl which can be substituted with up to two C<sub>1</sub>-C<sub>4</sub> alkyls and R<sup>5</sup> is an hydrolytically susceptible linking moiety comprising C, H and two or more heteroatoms which can be O, S or N, the O, S and N atoms all participating in hydrolytically susceptible bonds or ether or thioether bonds.

- 30           12.    A polyanionic polymer comprising hydrolytically susceptible bonds, the polyanionic polymer comprising:

- two or more polyanionic polymer segments;
- linking moieties coupling the polyanionic polymer segments, wherein the linking moieties comprise (I) or (II) below or both:

(I) a segment joined via amide, ester or thioester bonds incorporating an acyl or acyl analog moiety of the polyanionic polymer, wherein the segment comprises:

(a) a  $C_1$  to  $C_{12}$  alkylene with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds, provided that at least one of the amide, ester or thioester bonds is other than an ester bond; or

(b) an amide, ester or thioester linked polymeric segment of (i) hydroxy or thiol  $C_2$ - $C_5$  carboxylic acid or hydroxy proline derivatives and (ii) {(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds or (b) an  $\alpha,\omega$ -diol or a chain extended  $\alpha,\omega$ -diol}; or

(c) an amide, ester or thioester linked polymeric segment of (i) one or more hydroxy or thiol  $C_2$ - $C_5$  carboxylic acid or hydroxy proline derivatives, (ii) {(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds or (b) one or more  $\alpha,\omega$ -diols or chain extended  $\alpha,\omega$ -diols} and (iii) one or more carbonyldioxy moieties; or

(d) an amide, ester or thioester linked polymeric segment of (ii)(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds, (ii)(b) one or more chain extended  $\alpha,\omega$ -diols and (iii) one or more carbonyldioxy moieties; or

(e) an amide, ester or thioester linked polymeric segment of (ii)(b) one or more chain extended  $\alpha,\omega$ -diols and (iii) one or more carbonyldioxy moieties; or

(f) a direct anhydride formed between acid moieties of the polyanionic polymer; or

(g) an anhydride bridge formed between acid moieties of the polyanionic polymer with carbonyl bridge; or

5 (I) the residue after a crosslinking reaction of:

(a) two or more terminal acrylate or methacrylate moieties providing unsaturated bonds available for the crosslinking reaction;

10 (b) a segment joining the terminal acrylate or methacrylate moieties via amide, ester or thioester bonds incorporating an acyl bond of the acrylate or methacrylate moieties, wherein the segment comprises:

(1) a  $C_1$  to  $C_{12}$  alkylene with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds, provided that at least one of the amide, ester or thioester bonds is other than an ester bond; or

15 (2) an amide, ester or thioester linked polymeric segment of (i) hydroxy or thiol  $C_2$ - $C_5$  carboxylic acid or hydroxy proline derivatives and (ii) {(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds or (b) an  $\alpha,\omega$ -diol or a chain extended  $\alpha,\omega$ -diol}; or

20 (3) an amide, ester or thioester linked polymeric segment of (i) one or more hydroxy or thiol  $C_2$ - $C_5$  carboxylic acid or hydroxy proline derivatives, (ii) {(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds or (b) one or more  $\alpha,\omega$ -diols or chain extended  $\alpha,\omega$ -diols} and (iii) one or more carbonyldioxy moieties; or

25 (4) an amide, ester or thioester linked polymeric segment of (ii)(a) a  $C_1$  to  $C_{12}$  alkylene moiety with terminal linkers selected from oxy, thio (-S-) or imino (-NR-, where R is H or  $C_1$ - $C_6$  alkyl) incorporated into the amide, ester or thioester bonds, (ii)(b) one or more chain extended  $\alpha,\omega$ -diols and (iii) one or more carbonyldioxy moieties; or

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